## s19 Matrix Exam (practice v111)

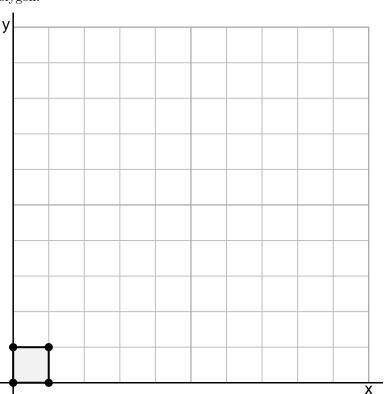
Let the  $2\times 4$  matrix U represent four points in the xy-plane (so each column represents a point). When those four points are connected as a convex polygon, matrix U represents a unit square. Also, let the  $2\times 2$  matrix L represent a linear transformation.

$$U = \begin{bmatrix} 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 \end{bmatrix} \qquad L = \begin{bmatrix} 7 & 3 \\ 1 & 9 \end{bmatrix}$$

Let matrix  $P = L \cdot U$ , so P is found by matrix multiplication of L times U. Matrix P also represents 4 points of a polygon. Use the diagram below to calculate the elements of P. Then, draw the polygon represented by matrix P on the xy-plane below. Notice I have already drawn the unit square represented by matrix U.

1. Multiply  $L \cdot U$  and draw resulting polygon.

|   |   | ı |   | ı | ı |
|---|---|---|---|---|---|
|   |   | 0 | 1 | 1 | 0 |
|   |   | 0 | 0 | 1 | 1 |
| 7 | 3 |   |   |   |   |
| 1 | 9 |   |   |   |   |



2. What is the area of the convex polygon represented by matrix P? Hint: the area equals the absolute value of the determinant of matrix L.

The triangle shown below is composed of the three points represented by matrix  $A = \begin{bmatrix} 10 & 10 & 5 \\ 10 & 5 & 10 \end{bmatrix}$ . In order to reflect over the x axis and then rotate by 306.87° counterclockwise we can multiply by the transformation matrix  $R = \begin{bmatrix} 0.6 & -0.8 \\ -0.8 & -0.6 \end{bmatrix}$ .

3. Calculate the matrix  $R \cdot A$ .

4. Draw the triangle represented by  $R \cdot A$ .

